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ART. IV.—THE SANITARY AND PHYSIOLOGICAL RELATIONS OF TOBACCO.

THERE is a substance belonging to the vegetable kingdom of Nature for which man has so strong an appetite that one of the first things he does, on emerging from the lowest depths of barbarism, or becoming acquainted with its virtues, if already civilized, is to provide himself with it, if he can. In vain he is told it is poisonous to him and his future progeny ; in vain are abuse and ridicule heaped upon him ; in vain he is censured and punished ; in vain he is cursed as an obstinate wretch, whose persistence in wrong-doing puts him in danger of losing his soul. With a total disregard to his pocket, his body, his morals, his salvation, he smokes, chews, or snuffs his tobacco, and smiles benignantly, but defiantly, at the enemies whose efforts have done so little to thwart him in his pursuit of pleasure.

It is certainly true that the great majority of those who have inveighed against the use of tobacco belong to that class of persistent reformers who deem it their duty to attack every habit or custom which results from civilization. To them the refinements of life are an evidence of man's degeneracy. They hold up the barbarian as the highest type of the genus *homo*. They speak of his well-developed form, his great powers of endurance, his simple and guileless nature, his capacity for mental improvement, even though his mind be "rude and untutored." In all this they show themselves as deficient in anthropological knowledge as they are ignorant of the scientific relations of the tobacco question.

Again, they appeal to statistics. They visit the alms-houses, prisons, and insane asylums, and, by a *post hoc ergo propter hoc* process of reasoning, have no difficulty in arriving at the conclusion that the use of tobacco makes paupers, criminals, and lunatics. Of course, no one pretends to doubt that a man may injure himself by tobacco, as he may by cheese or crackers. The skilful reformer, therefore, does not waste his powder upon excess, but brings his heaviest guns to bear on the question of moderate use. It would, of course, be equally

easy to show, by a similar course of procedure and reasoning, that eating potatoes — no, not potatoes, for they, too, have been attacked, but bread and milk — predisposes to poverty, crime, and insanity.

Then, occasionally, some physician or surgeon, ignorant of Oesterlen and his “*Medical Logic*,” comes upon the field, and relates how a patient of his had a cancer of the tongue or lip, and how, after many fruitless endeavors to determine the cause, it was finally ascertained that he had long been in the habit of smoking. Another traces a large majority of his cases of amaurosis to the use of tobacco ; a third finds that the “weed” produces softening of the brain and paralysis, even when indulged in with moderation ; and a fourth is sure that a general deterioration of the powers of life is the result of a few daily whiffs of a pipe or cigar.

Whilst it is doubtless true that the excessive use of tobacco may occasionally give rise to disease, it has never been shown that this substance, when used with becoming moderation, causes any serious derangement of the mental or physical organization. There are, doubtless, individuals who cannot smoke a mild cigar without having their nervous system unstrung for several days ; but the existence of such persons proves nothing against tobacco that cannot by similar facts be alleged against many articles of food and drink which to ninety-nine men and women out of a hundred are agreeable and wholesome. There are people who cannot eat shell-fish, or sea-bass, or strawberries, without the indulgence being followed by a cutaneous eruption, a headache, or some other disturbance of the physical organism. There is no accounting for idiosyncrasies ; what is pleasant and beneficial to one man is distasteful and injurious to another ; and therefore the fact that some persons cannot use tobacco ever so temperately without suffering inconvenience is certainly no argument against moderate indulgence on the part of others in whom no deleterious action is produced.

Those who, at the present day, decry the use of tobacco are generally drinkers of tea or coffee, which they imbibe unconscious that they are obeying the same instinct that prompts others to smoke. They forget, too, if they ever knew, that

these substances have received quite as bad a name from superficial observers as the one to which they are so inimical. Thus, tea is asserted to possess the power of drying up the juices, to bring on a premature old age, and to predispose to attacks of neuralgia. Coffee has the reputation, among some, of destroying the virile power, of producing paralysis, and of causing a gradual, but certain, emaciation. Though there is probably no foundation for these statements, it is assuredly proved, by the experience of every physician in active practice, that there are as many persons to whom tea and coffee are injurious as there are persons who are harmed by the moderate use of tobacco.

It is very commonly the case that those who engage in the crusade against tobacco are skilful in making assertions and artful in drawing inferences, so that they impose upon the general public, which rarely takes the trouble to inquire into the truth or falsity of dogmatic statements enforced in strong language, or to examine carefully the arguments brought forward. But for one accustomed to think, to believe no allegation in science without the proof, and to sift thoroughly every question submitted to his judgment, there is something ludicrous in the exhibition of incorrect assertions, bad reasoning, and deplorable ignorance, which is to be found in some recent strictures upon the moderate use of tobacco. To take up, *seriatim*, these fallacies, and to show the absurdity of all the statements made, would not be worth the trouble. Without, therefore, replying to any particular diatribe, it is proposed to point out as briefly as possible the sanitary and physiological relations of a substance which for more than three hundred years has played no unimportant part in the physical and intellectual development of mankind.

Many of the older authors who wrote upon *médecine* denounced tobacco as a substance capable, even when moderately used, of inflicting great injury upon the system. Thus, Van Helmont declared that he had examined the stomach of a smoker which had been colored brown by the fumes of tobacco. Hoffmann contended that those who were addicted to indulgence in tobacco suffered from pains in the chest, were subject to delirium, nightmare, convulsions, etc., and that

after death, on making examination of their bodies, he had almost always found the lungs blackened by the smoke, and dried like flesh subjected to heat. He also states, that, having one day opened the cranium of an executed criminal who had been a great smoker, he had found the brain blackened. Parrius, in making the dissection of the body of a young man, found the brain covered with a black soot, which he attributed to inflammation. Those, however, who had known the man declared that he had always been healthy, but had been addicted to the use of tobacco; whereupon Parrius changed his opinion, being now sure that the substance was derived from the smoke which had been inhaled. Bonetus asserted that many *post-mortem* examinations had convinced him of the evil effects of tobacco on the lungs and brain; and Paulli thought that the smoke dried the lungs and produced *marasmus*.

Sovereigns, actuated, perhaps, by a desire to protect their subjects from the supposed deleterious effects of tobacco, wrote against it, and occasionally went so far as to inflict severe punishment on those who used it. The Shah Abbas of Persia cut off the nose and lips of any one caught smoking; and the Sultan Amurath IV. of Turkey, under the impression that tobacco would make his subjects impotent, prohibited its use under pain of death. But all was of no avail. The habit became fully established among the Turks; and, as regards the Persians, a traveller, writing sixty years after the death of the Shah Abbas, says: "The mania for smoking is general in Persia. Every one transacts his business with his pipe in his mouth. In the colleges the professors and students smoke whilst occupied with their duties. The people would rather go without their food than their smoke. During their Lent, or *Ramadan*, they are obliged to go eighteen hours without eating. The first thing with which they break their fast is tobacco." The Sultan Mahomet IV. ordained, among other cruel punishments, that every person found smoking should have his nose pierced with his pipe. The Czar Michael Fedorovitch condemned all smokers to the *bastinado*, and occasionally cut off the nose of an obstinate offender. James I. of England denounced the use of the weed

in severe terms. Pope Urban VIII. issued a bull against the practices of smoking and snuffing in church, and thundered with all the artillery of the Vatican against those who thus desecrated the holy edifices. Clement XI., however, revoked this bull, except as regarded St. Peter's. And as an evidence of the firm hold which tobacco has obtained upon the most elevated personages of the earth, it may be mentioned that the present Holy Father — certainly as worthy an occupant of the chair of St. Peter as any of his predecessors — takes his snuff even in the great basilica.*

In spite of all opposition, the use of tobacco continued to extend, and occasionally a writer, bolder than others, urged its claims to favorable consideration. Thus, Willis declared that it enabled men to endure great fatigue, and that accordingly it was especially beneficial to soldiers. During the conquest of Holland, Louvois made more effort to get tobacco for his troops than to supply them with food. Péron asserted, that, when travelling in desert places, he felt neither hunger nor fatigue after having chewed a little tobacco.

The first question to which we propose to direct attention is that relating to the general sanitary effects of tobacco upon the human system. Ramazzini, in 1713, made some observations which were among the first that have any appearance of exactness. In his *De Morbis Artificum Diatriba*, he makes the statement that those who work in tobacco factories are subject to violent pains in the head, nausea, and constant sneezing. Patissier, † who translated his work into French, declares that they are, in general, thin, yellow, and asthmatic. He admits, however, that many are not injuriously affected, and, on the authority of Fourcroy, states that the workmen in the tobacco factory at Cette, in Languedoc, in no way suffer; on the contrary, they are less subject than the other inhabitants of Cette to the putrid fevers which prevail in that city during the spring.

* For a short, but interesting, account of the persecutions to which the votaries of tobacco have been subjected, the reader is referred to *Histoire du Tabac: ses Persécutions*, par C. Barbier, Deuxième Édition, Paris, 1861. Most of the statements in the text have been derived from this source.

† *Traité des Maladies des Artisans*, etc., Paris, 1822, p. 202.

M. Pointe * made some careful observations on the health of men working in a tobacco factory at Lyons. They were five hundred in number, and, though employed in various ways, were all of them in continual contact with tobacco. He found them especially liable to pulmonary consumption, diseases of the eyes, boils, and scurvy. On the other hand, they were exempt to a considerable extent from intermittent fever and scrofula, to which the inhabitants of Lyons are very subject. The latter affection is particularly prevalent among the operatives in the silk factories. The workmen in the tobacco factory were not affected with trembling or other disorder of the nervous system.

Thackrah † states, that, although tobacco manufacturers are exposed to a strong narcotic odor, and in the storing department to a high temperature, they appear to be healthy. But perhaps the most thorough researches relative to the influence of the tobacco manufacture on health are those carried on several years ago by Parent-Duchâtelet. ‡ This eminent hygienist, after a very careful series of investigations, arrived at the conclusion that the workers in tobacco are as healthy in appearance, and in fact, as other laborers. He ascertained that they in a short time become accustomed to the effect of tobacco inhalations and to the constant contact with this substance; they do not become liable to any special diseases, and they live as long as other people.

The reports of the officials attached to the government manufactories of tobacco in France are said by Lévy § to confirm this opinion. The documents on the subject, for the year 1842, show, first, that the workmen have not been affected with any disease that could properly be attributed to tobacco; second, that the tobacco appears to have acted as a preserva-

* Observations sur les Maladies auxquelles sont sujets les Ouvriers employés à la Manufacture Royale de Tabac de Lyon. Lyon, 1828.

† The Effects of the Principal Arts, Trades, and Professions, etc., on Health and Longevity. American Edition, Philadelphia, 1831, p. 47.

‡ Mémoire sur les véritables Influences que le Tabac peut avoir sur la Santé des Ouvriers occupés aux différentes Préparations qu'on les fait subir (Ann. d'Hyg. publ. et de Méd. lég., Tom. I., p. 169).

§ Traité d'Hygiène publique et privée. Quatrième Édition, Tom. II., Paris, 1862, p. 926.

tive against some diseases, and particularly as a preventive of the typhoid fever at Lyons, dysentery at Morlaix, and the sweating fever at Tonneins.

The observations of Melier* lead to conclusions the opposite of those arrived at by Parent-Duchâtelet; but his results must, in part at least, be attributed to the fact that other causes than mere contact with tobacco have, since Parent-Duchâtelet's researches, been in operation in the factories. Thus, we find that the processes necessary to the preparation of the cured leaves extend over eighteen or twenty months, and that during this period the workmen are exposed: first, to the effects of severe muscular exertion; second, to an atmosphere charged with a fine and acrid dust; third, to moisture and cold; fourth, to emanations from the fresh and humid plant; fifth, to stronger emanations and to gas developed by high temperature; sixth, to the emanations and gases developed by fermentation; seventh, to similar exhalations accompanied by the dust of the tobacco; eighth, to the dust alone.

Subjected to the action of such causes, it would be no matter for surprise, if disorder of the system should occur in all cases. But notwithstanding the inhalation of solid particles of tobacco into the lungs, the respiration of an atmosphere loaded with ammoniacal gas, and exposure to excessive moisture and heat, the workmen become in a measure acclimated, and forget the unfavorable circumstances which surround them. They take no precautions to avoid actual contact with the tobacco. They eat in the factories without washing their hands; and, as if not sufficiently saturated with tobacco, smoke or chew it whilst engaged in their labors. Gradually, however, the unfavorable hygienic conditions do their work, and the men become pale and cachectic. That these ill effects are not due to tobacco, however, is established by the researches of Parent-Duchâtelet already cited, and by the fact that Boudet has never been able to find nicotine in the blood of the most degenerate of the workmen. As to longevity, Ruef found in a factory having one hundred and twenty-three workmen five

* De la Santé des Ouvriers employés dans les Manufactures de Tabac (Bulletin de l'Académie de Médecine, Tom. X. p. 569).

above the age of seventy-two, and of these, four had worked at the business all their lives. It would appear also to be certainly established that the manufacture of tobacco has a tendency to exempt from certain fevers, dysentery, rheumatism, neuralgia, itch, and pulmonary consumption. So far, therefore, as Melier's investigations go, the balance does not appear to be very much, if at all, against tobacco.

In 1843, M. le Vicomte Siméon,* director-general of the tobacco manufacture of France, published a work which discusses to some extent all the questions connected with the influence of the various processes on the health of the workmen. His conclusions are: 1st, That the hygiene of the tobacco-workers is excellent; 2d, That, during the year 1842 (to which alone the report refers), there was no particular disease prevalent among the workmen which could be attributed to tobacco; 3d, That this substance, far from being hurtful, has acted as a preservative from attacks of epidemics, of sweating fever, typhoid fever, and dysentery; 4th, That the neighborhood of a tobacco factory is an excellent place of residence for those affected with pulmonary consumption.

With the view, however, of more fully satisfying myself in relation to the matter under consideration, I have recently visited the tobacco manufactory of M. Pierre Lorillard, who was kind enough to afford me every facility for making the fullest investigations. In this factory, probably the largest in the world, all the operations necessary to the preparation of smoking and chewing tobacco and snuff are carried on. Over three hundred men and women are employed, and many of them have been at the business since they were children. They are in constant contact with the tobacco, in some form or other, during the whole time they are at work.

In the curing-room they handle the leaves in a wet state, and for a great portion of the time have their hands and arms dipped in strong infusions of tobacco. The temperature of this room is kept at about 80° Fahr., and the odor is very strong. All the operatives were of healthy appearance, and apparently suffered no inconvenience from their labor.

* Rapport à M. le Ministre du Commerce (Ann. d'Hyg. et de Méd. lég. Tom. XXX. p. 243).

In the stemming-room women are employed. They handle the wet leaves after they have left the curing-room, and strip off their stems. They were all healthy, and several of them were possessed of far more ruddy complexions than are commonly seen in our streets. Here the odor of the tobacco was very strong.

In the cutting-room not only are the workmen exposed to the emanations from the tobacco, and to actual contact with it, but the atmosphere is pervaded with particles of powdered licorice, which is here sprinkled over the leaves. All were of strong, healthy appearance.

In the drying-room the temperature is maintained at about 100° Fahr. The atmosphere was certainly very oppressive, and was decidedly ammoniacal. The workmen do not stay in this room, but they are there very often during the day. One of them, a remarkably strong, well-built, and healthy man, informed me that he had worked at the business over thirty-five years.

In the snuff-room were two men who had worked, one of them sixteen, and the other forty-two years. The latter stated that he had never taken a dose of medicine in his life. All the operatives were of healthy appearance.

The next room visited was in a cellar. Here the snuff is packed in bladders. Three men were employed at this work. The atmosphere was literally loaded with tobacco in fine powder. No miller was ever more thoroughly covered with flour than were these men with tobacco-dust. It was in their hair, their eyes, their ears, their mouths, and entered the lungs with every inspiration. One of them had worked seventeen years. He was large, well-formed, and of remarkably healthy appearance. Another was sixty-three years old, and had been forty-five years engaged in this work. His face was covered with tobacco-dust, his nostrils were full of it, and even his teeth and gums showed its presence in large quantity. In answer to my inquiries, he informed me that he had always enjoyed good health, but occasionally had nervous twitchings of his face. It is impossible to conceive of any situation in which greater exposure to the influence of tobacco could exist than in this room.

All the operatives were cheerful and intelligent, and I did not see one who appeared to suffer any ill effects from his labor, unless the old man in the snuff-packing room be an exception. Not only do they handle the tobacco, inhale it, eat it, and steep their hands in an infusion of it, during their work, but they chew, smoke, and snuff it for pleasure, almost without exception.

The superintendent, a very intelligent man, had worked at the business many years, had never suffered any inconvenience from it, nor heard of any diseases being induced in those who had made the tobacco manufacture their employment.

Nor when we come to inquire into the sanitary condition of those who use tobacco with discretion, for the real or supposed pleasure they derive from it, do we find any evidence that it produces mental or physical disease. The number of persons who smoke, chew, or snuff is so vast that a man who does not do one or another is an exception. Certainly, if tobacco were capable of inducing actual disease, or even of lessening the vital powers, when used in moderation, we should not be in doubt on the subject. That it may cause disorder of the system, when used in excess, no hygienist or physiologist will deny; but that it possesses any pre-eminence in this respect over tea, coffee, pepper, mustard, salt, or many other substances, is very questionable. Sichel, the eminent French ophthalmic surgeon, has recently written a paper in which he describes a kind of amaurosis produced by the excessive use of tobacco. His principal case was that of a man forty years of age who smoked his pipe continuously all day, and even went so far as to have it well filled near him when he slept, so that he could wake up in the night several times and take a few whiffs. Certainly this is an example of the abuse, not the use, of tobacco. Yet there is no clear connection between the alleged cause and the effect. Sichel's opinion, that few persons can for a long time consume more than twenty grammes of tobacco daily without their vision and their memory becoming enfeebled, is an unfounded statement which makes us look with suspicion upon his other theories. Stellwag,* the most emi-

* A Treatise on Diseases of the Eye, etc. Am. Ed. Translated by Drs. Hackby and Roosa. New York. 1868. p. 668.

nent German authority, in his recent treatise, doubts the existence of tobacco-amaurosis; and the chief and latest English authority, Mr. Soelberg Wells,* is even more emphatic. He says:—

“One argument which has been brought forward to lend special weight to the theory that tobacco may produce amaurosis is, that simple progressive atrophy of the optic nerve occurs far more frequently among men than women. Whilst readily conceding this, I must also call attention to the fact that the causes which may produce amaurosis obtain far more amongst men than women. Thus, the former are, as a rule, exposed to far greater corporeal and mental labor, to greater vicissitudes, and to a greater indulgence in free living of every kind. Moreover, in all probability, the amaurosis is far more due to a combination of such deleterious influences than to the prevalence of one special one, e. g. tobacco; at least, in by far the greater number of cases of amaurosis which I have met with in heavy smokers, the patients readily admitted their indulgence in other excesses. I freely admit the fact that the excessive use of tobacco (but most frequently together with other causes) may produce considerable impairment of vision, and finally, if the habit be not entirely changed, and the use of tobacco, stimulants, etc., given up, even atrophy of the optic nerves. But I cannot, from my own experience, accede to the doctrine that there is anything peculiar in the form of atrophy of the optic nerve which would at once enable us to diagnose the disease as depending upon excessive smoking.”

It will be observed that Mr. Wells's remarks are limited to the immoderate use of tobacco, and apply chiefly to its action in connection with excesses of other kinds. The special inquiries which I made of the operatives in Mr. Lorillard's factory, and my inspection of their eyes, failed to show the existence of any case of impaired vision.

The assertion has often been made that the use of tobacco causes insanity. Careful observation shows, however, that this is not correct. Soldiers and sailors, almost without exception, use tobacco in some form or other, and it is well known that they are remarkably exempt from mental disease. Then, too, the fact that women, who, as a rule, do not use tobacco, are as liable to insanity as men who do, is a sufficient answer to this charge.

* A Treatise on the Diseases of the Eye. Am. Ed. Philadelphia. 1869. p. 411.

But even in regard to this point we have some very exact observations. During the past year M. Ducamp * has been examining the government tobacco manufactories of France, and has incidentally touched upon the sanitary relations of the substance in question. Alluding to the statement made by a learned academician, that the increase of insanity in France was due to the enormous consumption of tobacco, M. Ducamp observes, that the learned doctor forgot to deduct forty-seven per cent of the lunatics as being females, and that the probable cause of the increase of insanity is to be found in the abuse of *absinthe*, a liquor which contains seventy-two per cent of alcohol. He then instances the case of the sailors, who by constantly chewing tobacco are more liable to suffer from it than those who smoke, yet the 30,000 sailors manning the fleet show just their normal proportion of lunatics. Among the numerous *employés* of the factories no special maladies are to be observed.

In entering upon the consideration of the physiological effects of tobacco, it may be necessary to say a few words in regard to the functions of the waste and repair of the animal tissues.

Every action of any organ of the body is accompanied with the decomposition of a certain amount of the substance of such organ. Thus, when a muscle contracts, a portion of its tissue is broken up into substances of a lower grade. These enter the blood, and are finally excreted from the body through the emunctories of the skin, lungs, and kidneys. Every pulsation of the heart, every action of any gland, every thought of the brain, involves the disintegration of heart, gland, or brain substance, respectively.

Of course, it needs very little reflection to convince any one, that, if this waste goes on without the production of new matter, a period will be reached at which action is no longer possible. To provide, therefore, for the loss which is continually taking place, we eat food, which undergoes the necessary transformations in the body, and eventually is deposited where it is wanted, whether in the muscles, the glands, the brain, or

* Revue des Deux Mondes, Août 1, 1868. Also, for a short abstract, Quarterly Journal of Psychological Medicine, etc., December, 1868, p. 828.

other organs. The process by which the tissues break up into inorganic matter is called regressive or destructive metamorphosis; that by which new life is formed from the food, progressive metamorphosis. When in an adult person these two processes balance one another, the body undergoes no variation in weight. If the first is in excess, the body is consuming its capital, and loses weight; if the second, the body is "laying up for a rainy day," and gains weight.

Now one of the physiological effects of tobacco is, that it retards the regressive or destructive metamorphosis of the tissues. In other words, it enables an individual to save his body-capital.

Let us suppose a ploughman, who has a certain amount of work to do every day, and a certain amount of food to live upon, and finds, under these circumstances, that he is slowly, but steadily, losing weight. To arrest his downward course, he might, if able, do one of two things, — work less, or eat more. His condition is such, however, that he can do neither. He has his daily work to perform, and he is too poor to get more food. But there is a compensating agent which will relieve him from his difficulty. Let him smoke two or three pipes of tobacco daily, and he will ascertain that he ceases to lose weight, though he has not diminished the amount of his labor or increased the quantity of his food. The tobacco has enabled him to do the same work with a less expenditure of material, and has therefore retarded the destructive metamorphosis of his tissues.

Twelve years ago I undertook upon my own person a series of experiments, with the view of determining, among other things, the influence of tobacco upon the function of destructive metamorphosis.* These investigations were the first of the kind ever made. I have several times since gone over the same ground, and have always obtained analogous results. Previously to that occasion, I had not been in the habit of smoking, or using tobacco in any other form.

The objects in view were: —

* The Physiological Action of Alcohol and Tobacco upon the Human Organism. *American Journal of the Medical Sciences*, October, 1856. Also, *Physiological Memoirs*. Philadelphia, 1863. p. 44.

1st, To ascertain the effects of tobacco, when a sufficient quantity of food was digested to maintain the weight of the body.

2d, To determine the influence of tobacco, when the food was insufficient, and when, consequently, the body was losing weight.

During the continuance of the experiments, I lived in the most systematic manner, rising every morning at six o'clock, and going to bed at eleven. I was thus awake seventeen hours, and asleep seven. The seventeen waking hours were thus appropriated: ten to study, of as uniform a character as possible; five to daily duties, recreation, etc.; and two to a uniform system of physical exercises. This plan was rigorously carried out through the whole course of the investigations.

The experiments related to the weight of the body, the quantity of carbonic acid and aqueous vapor expired in respiration, the extent of loss through the intestines and kidneys, and the determination of the amount of urea, uric acid, chlorine, and phosphoric and sulphuric acids excreted. These substances are, as it were, the ashes of the body, being the products of its waste from the performance of its several functions. Besides these special determinations, I observed minutely every circumstance connected with my general health which could reasonably be ascribed to the action of the tobacco.

In the first place, I instituted a standard series of experiments, using just sufficient food to maintain the weight of the body as nearly as possible at a fixed point. During this series of experiments, I made all the determinations above specified. They were continued for five days.

During the next series I lived exactly as during the standard experiments, except that I smoked one hundred and fifty grains of tobacco — nearly two cigars — after each meal, being four hundred and fifty grains a day. This series also lasted five days.

The results were, that the loss by the lungs, kidneys, etc., was lessened, and that the weight of the body had increased .07 of a pound. The exact weights, together with the processes employed, will be found in the paper to which reference has been made.

As I had not been accustomed to the use of tobacco, the general and more obvious effects were exceedingly well marked. There was great nervous excitement, accompanied with irregular action of the muscles, more particularly of the eyelids, mouth, and arms, which lasted for about two hours. The mind, however, was clear, and there was no headache. These sensations were succeeded by a pleasant feeling of ease and contentment, which also lasted about two hours. During the first part of the night there was wakefulness; but this was always followed by a sound sleep, which continued till the hour for rising. The pulse was somewhat increased in frequency; the appetite continued good.

With the object of still further determining the action of tobacco, I was desirous of ascertaining its influence when the amount of food daily taken was not sufficient to maintain the weight of the body. I, therefore, for five days, ate an insufficient quantity of food, so that at the end of this period my weight had fallen from 225.81 pounds to 223.97, showing a total loss of 1.84 pounds, or an average daily of .37 pound.

Under this condition of the system, and still continuing the diminished food, — the exercise and all other factors being unchanged, — I smoked one hundred and fifty grains of tobacco after each meal. The effects were, that the rate at which the body had been losing weight was lessened from the first, and entirely overcome the fourth day, the average daily loss being .09 of a pound against .37 of a pound under the same conditions, except the use of tobacco. The effect upon the excretions was similar to that observed during the first series with tobacco. The general influence, likewise, was about the same.

During the series of experiments immediately preceding, when the food was insufficient to maintain the weight of the body, there had been an almost constant sensation of hunger, and a marked degree of debility. Neither of these conditions existed after the use of the tobacco was begun.

From the whole of the experiments I concluded: —

1st, That tobacco does not materially affect the excretion of carbonic acid through the lungs.

2d, That it lessens the amount of aqueous vapor given off in respiration.

3d, That it diminishes the amount of the intestine excretion.

4th, That it lessens the quantity of the renal excretion, and the amount of its urea and chlorides.

5th, That it increases the amount of free acid, uric acid, and sulphuric and phosphoric acids eliminated through the kidneys.

The general purport of the experiments, therefore, is, that tobacco retards the waste of the tissues, though the fact that it increased the amount of phosphoric acid eliminated would seem to show that the destructive metamorphosis of the nervous tissues was increased. It must be remembered that the amount of tobacco used was large, — amounting, as it did, to six cigars a day. Subsequent experiments which I made, smoking only three cigars daily, one after each meal, showed that the effect of this moderate amount was to decrease the quantity of phosphoric acid excreted from the system. It was ascertained from these, that tobacco in moderation lessens the destruction of the tissues as a whole, and especially diminishes the wear and tear of the nervous system.

The question, therefore, scarcely admits of a doubt, that, other things being equal, a person can do more mental and physical labor, and with less fatigue, under the moderate use of tobacco, than without it. The excessive use may be injurious, just as may be the excessive use of almost any substance taken as food or drink.

Another important physiological effect of tobacco is seen in its action upon the stomach, as increasing the secretion of gastric juice, and thus promoting digestion. It is a well-recognized physiological fact, that a very intimate sympathetic connection exists between the stomach and the salivary glands. A mild sensation of hunger makes the “mouth water,” and an increase in the quantity of saliva created is almost invariably attended with an increase in the quantity of gastric juice. This is shown by making a fistula in the stomach of a dog, so that the gastric juice can be collected as soon as it is formed. Now, if any strongly sapid substance — as a piece of tobacco, for instance — be put into the dog’s mouth, an increased se-

cretion of saliva takes place, and at the same time gastric juice is formed in large quantity, and pours through the fistula into a vessel placed to receive it. A cigar acts in the same way upon the salivary glands and stomach of a smoker. To smoke after meals is, therefore, a perfectly orthodox physiological act, and is another example of coincidence between instinct and science. Many cases of dyspepsia are cured by this simple means.

Tobacco, by diminishing the destructive metamorphosis of the tissues, enables mankind to support the effects of hunger with less loss of strength, and less bodily and mental fatigue, than would otherwise result. The experience of soldiers and travellers suffices to establish this fact, and is a matter of such popular notoriety that it is scarcely necessary to cite examples. I have frequently noticed the phenomena in my own person.

But the chief influence of tobacco is exerted upon the brain and other parts of the nervous system, and it is mainly to secure this effect that man uses the substance at all. The tendency of civilization is to increase the wear and tear of nerve tissue. New pursuits, new duties, the spread of learning, the discoveries of science, the struggle for wealth and position, the turning of night into day, and hundreds of other factors, act with a power under which many minds go down into darkness, and others are more or less shattered. To avoid the action of these causes is impossible, without a thorough change in the condition of society, and an arrest of the mental development of mankind. Even if we could accomplish either of these ends, it would certainly be undesirable to make the attempt.

But it is assuredly proper for us to look for some means capable of lessening the ill effects which are produced by the labors, the anxieties, the sorrows, the troubles, of which every man who keeps up with the world must expect to bear a large share, and which cannot be altogether avoided by persons of the most quiet pursuits.

Among the substances which man has been led to use in order to bring about this result, tobacco is one of the most efficacious, as it is the least harmful. As a soother to the nervous system, and a promoter of reflection, it acts with a degree

of certainty, and yet of mildness, which places it far above all its congeners. Under its influence the nervous substance, especially that of the brain and sympathetic system, is preserved from the inroads to which it would otherwise be subjected. The ability to comprehend is increased, the judgment is rendered clearer, the power of the will is augmented, and all this without the degree of exhaustion which otherwise follows every prolonged mental effort. The greatest men the world has ever seen used tobacco, and men, both great and commonplace, will continue to use it till they get something better.

But tobacco, to be most advantageous to mankind, should be used with moderation. Like every other good thing, it is a two-edged sword, and, when employed to excess, it often causes neuralgia, indigestion, and more or less derangement of the whole organism. It is wonderful, however, to see how many persons can endure the abuse of tobacco without apparent inconvenience. Those most liable to suffer are youths whose nervous systems are undeveloped, and to whom it is no more suited than pork and beans for an infant's stomach.

Whether, therefore, we regard the use of tobacco in moderation from a sanitary or physiological point of view, we find no grounds for the apprehensions which have been expressed relative to its deleterious influence. On the contrary, it is very certain that the moderate habitual use of the substance in question is often decidedly beneficial, and that many persons become so accustomed to excess, or are so constituted, that they are not injuriously affected, even though they smoke, chew, snuff, and pass the greater part of their lives in an atmosphere saturated with tobacco and its exhalations.

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